

## STUDY ON SOIL RESOURCES AND THE LIMITING FACTORS OF LAND USE IN DRĂGĂNEȘTI AREA, PRAHOVA COUNTY

Mariana Mihaela PRISECARU (URZICĂ), Mircea MIHALACHE, Valentina Mihaela VASILE

University of Agronomic Sciences and Veterinary Medicine of Bucharest, 59 Marasti Blvd,  
District 1, Bucharest, Romania

Corresponding author email: mihaelapetcu2505@yahoo.com

### Abstract

The paper presents the pedological and agrochemical study elaborated on the territory of Dăgănești commune, Prahova county, it is intended for the foundation of the county (national) soil-land monitoring system for agricultural areas. The paper inventories soil resources, identifies and describes the limiting or restrictive factors of land use for agricultural production. The influence of relief on pedogenesis is generally manifested by altitude and, on small surfaces, by slope. In the presented case, the relief has little direct influence due to the morphological characteristics of the terrain: low altitudes and slopes, lack of exposure. Knowing the nature and intensity of the limiting factors of agricultural production is absolutely appropriate in the situation where the decision is made to reduce or eliminate their negative effects.

**Key words:** evolution, assessment, soil, fertility, limiting factors.

### INTRODUCTION

The studied territory is located in the south of Prahova county, at a distance of about 35 km from the municipality of Ploiesti.

The total area of Drăgănești commune is 8756 ha, of which 7514 ha were studied (mapped) (OSPA PRAHOVA, 2019), the studied territory is located in the south of Prahova county, at a distance of about 35 km from Ploiesti municipality (Chiuciu et al., 2017). It borders the following administrative territories:

- to the north - the administrative territories of Tomșani, Colceag;
- to the east - the administrative territories of Fulga, Ciorani;
- to the south - the administrative territory of Rădulești (Ialomița county);
- to the west - the administrative territories of Dumbrava, Rîfov, Gherghița.

Locally, three important geomorphological units are defined:

- a) high plain;
- b) Prahova river meadow;
- c) Cricovul Sarat river meadow.

The geological layers that served as parent rocks for the current soils in the researched perimeter, are of Lower Pleistocene age and are represented by sedimentary rocks made up of silty-psamo-psephytic materials, newer or older

depending on the distance from the two rivers that delimits the said interfluvium (Enescu et al., 2018).

The predominant material in the soils of the high plain is reworked loess (Ioniță et al., 2013). The parent rocks on which they evaluated the soils in the meadow are alluvial in nature with textures that vary from coarse to fine, and the rocks in the major basin are recent deposits consisting of coarse alluvium (Mihalache, 2015).

### MATERIALS AND METHODS

The average temperature per season is as follows (Figure 1):

- in winter – the average temperature is  $-0.5^{\circ}\text{C}$ .
- spring – the average temperature is  $+10.8^{\circ}\text{C}$ .
- summer – the average temperature is  $+21.1^{\circ}\text{C}$ .
- autumn – the average temperature is  $+11.3^{\circ}\text{C}$ .

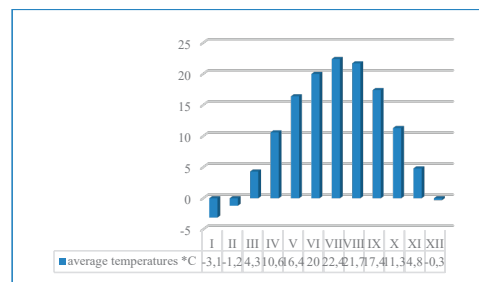


Figure 1. Average monthly temperatures

Average annual precipitation is in the range of 500 - 600 mm (ANM, 2022) (Figure 2).

The average annual measurements recorded in Ploiesti are 588 mm, in Armășești 466 mm, in the Ciupelnița rainfall point 621.0 mm (1966-1988) and the Drăgănești rainfall point 593.4 mm (1963-1988).

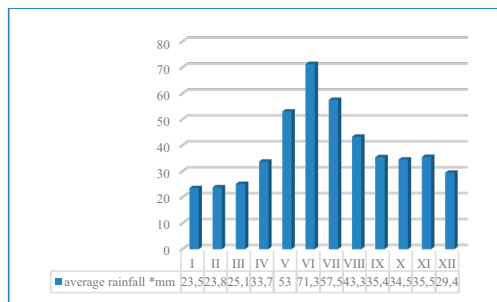


Figure 2. Average monthly precipitation

From the point of view of land use, the mapped surface is structured as follows:

- arable 6807.0 ha;
- pastures 685.0 ha;
- hay fields 7.0 ha;
- vines 11.0 ha;
- orchards 4.0 ha.

During the study, 358 main and secondary profiles were made, collecting a number of 295 pedological samples and 307 agrochemical samples analyzed in the O.S.P.A. laboratory Prahova, by the following methods:

- a) determination of soil reaction - pH – the potentiometric method
- b) determination of carbonates –  $\text{CaCO}_3$  (%) – SCHEIBLER gas volumetric method
- c) determination of soluble salts - method of determination in aqueous soil extract
- d) humus determination (%) – the WALKLEY-BLACK method modified GOGOĂȘA.
- e) nitrogen index - IN – by calculation according to the content in humus and the degree of saturation in bases ( $\text{IN}=\text{H}\%*\text{V}\%/100$ ).
- f) determination of mobile phosphorus –  $\text{P}_2\text{O}_5$  (ppm) – in lactic acetate extract according to EGNER-RIEHM-DOMINGO
- g) determination of mobile potassium –  $\text{K}_2\text{O}$  (ppm) – the flame-photometric method
- h) granulometric analysis (texture) – pipetting, sieving – the KACINSKI method (ICPA, 1987).

**TERRITORIAL LAND UNIT (U.S.) No. 1. FLUVISOLS** *entic calcareous gleic saline,*

*moderately salinized glaciated weakly proxicalcalcareous, LL/LN on coarse fluvial deposits, weakly-moderately polluted with animal droppings.*

*Location:* Prahova County, Drăgănești Administrative Territory.

*Distribution:* in the southwest of the commune, along the river Prahova.

*Aspect of the land surface:* high alluvial plateau, slope 01%.

*Natural conditions in which it occurs:* drift plain, groundwater Q4 1.41 – 2.00 m, cover with nitrophilous vegetation and sedges.

#### **CHARACTERISTICS OF THE SOIL**

**Horizon Ațsc 0-15 cm**, yellow color 5Y 7/6, monogranular structure, clay texture, strong effervescence, very low porosity, very compact, moist, skeleton below 2%;

**Horizon ACksc 15-35 cm**, yellow color 5Y 7/6, monogranular structure, sandy loam texture, strong effervescence, very low porosity, very compact, moist, skeleton below 2%;

**Horizon Ckgs 35-70 cm**, yellow color 7.5YR 6/8 with oxidation spots 10R 5/8, monogranular structure, sandy loam texture, strong effervescence, medium porosity, weakly compact, moist, skeleton below 2%;

**Horizon CkGosc from 70 cm**, yellow color 7.5YR 6/8 with oxidation spots 10R 5/8, monogranular structure, loamy sand texture, strong effervescence, medium porosity, weakly compact, moist, skeleton below 2%.

The physical and chemical characteristics of Fluvisols entic calcareous gleic saline, moderately salinized glaciated weakly proxicalcalcareous are presented in Table 1 and Table 2.

**TERRITORIAL LAND UNIT (U.S.) No. 2. PHAEZEMS** *Alluvial cambic, LA/LA on medium-fine fluvial deposits*

*Location:* Prahova County, Drăgănești Administrative Territory.

*Distribution:* in the north of the territory, on the sides of the Albești - Urziceni road and in the east of Braitaru village up to the Cricovul Sărat river.

*Aspect of the land surface:* high alluvial plateau, slope 01%, 07%.

*Natural conditions in which it occurs:* drift plain, groundwater Q5 3.01 – 5.00 m.

Table 1. Physical characteristics of the soil

Depth	Soil reaction (pH)	(CaCO <sub>3</sub> )	Humus (H)	Phosphorus (P)	Potassium (K)	Coarse sand (Ng)	Fine sand (Nf)	Loam (P I+II)	Clay (A)	Psychical clay (Af)
cm		%	%	ppm	ppm	%	%	%	%	%
0-15	7.68	7.7	2.16	24.6	236.0	18.9	40.0	20.2	20.9	32.9
20-30	7.54	7.2	1.26	16.0	116.0	10.3	58.7	17.7	13.3	22.8
50-60	7.85	8.3	-	-	-	3.3	70.4	12.8	13.5	17.2
90-100	7.95	8.3	-	-	-	1.9	73.8	17.4	6.9	18.4

Table 2. Chemical characteristics of the soil

Depth	CO <sub>3</sub> <sup>2-</sup>	HCO <sub>3</sub> <sup>-</sup>	Cl <sup>-</sup>	SO <sub>4</sub> <sup>2-</sup>	Ca <sup>2+</sup>	Mg <sup>2+</sup>	K <sup>+</sup>	Na <sup>+</sup>	Total salts
cm	mg/100 g soil								
0-15	-	51.8	25.9	52.8	44.0	3.7	6.2	-	177.8
20-30	-	42.7	26.6	105.6	55.0	9.6	4.5	-	233.8
50-60	-	44.5	19.5	235.2	47.6	15.0	1.2	-	379.4
90-100	-	39.7	21.3	67.2	42.4	6.0	1.2	-	184.4

**CHARACTERISTICS OF THE SOIL** (Table 3)

**Horizon Ap 0-21 cm**, dark brown color 10YR 3/3, disturbed structure, clay loam texture, no effervescence, low porosity, moderately compact, dry;

**Horizon Am 21-35 cm**, dark brown color 10YR 3/3, granular structure, clay loam texture, no effervescence, low porosity, moderately compact, dry;

**Horizon ABv 35-50 cm**, dark brown color 10YR 3/3, small angular polyhedral structure, clay loam texture, no effervescence, low porosity, moderately compact, dry;

**Horizon Bv 50-70 cm**, dark yellowish brown color 10YR 4/4, medium polyhedral structure, clay loam texture, no effervescence, low porosity, moderately compact, reed;

**Horizon BCn 70-90 cm**, yellowish brown color 10YR 5/8, massive structure, clay loam texture, no effervescence, very low porosity, very compact, stiff;

**Horizon Cn from 90 cm**, yellowish brown color 10YR 5/8, monogranular structure, clay loam texture, no effervescence, very small porosity, very compact, reash (Table 4).

Table 3. Physical characteristics of the soil

Depth	Soil reaction (pH)	(CaCO <sub>3</sub> )	Humus (H)	Phosphorus (P)	Potassium (K)	Coarse sand (Ng)	Fine sand (Nf)	Loam (P I+II)	Clay (A)	Psychical clay (Af)
cm		%	%	ppm	ppm	%	%	%	%	%
0-20	6.84	-	2.76	51.0	148.0	1.0	32.5	28.9	37.6	53.7
35-45	7.12	-	2.94	26.4	144.0	0.7	32.9	25.8	40.6	58.4
60-70	7.49	-	-	-	-	0.5	35.6	26.3	37.6	53.6
90-100	7.86	-	-	-	-	0.8	38.2	23.0	38.0	48.3

Table 4. Chemical characteristics of the soil

Depth	CO <sub>3</sub> <sup>2-</sup>	HCO <sub>3</sub> <sup>-</sup>	Cl <sup>-</sup>	SO <sub>4</sub> <sup>2-</sup>	Ca <sup>2+</sup>	Mg <sup>2+</sup>	K <sup>+</sup>	Na <sup>+</sup>	Total salts
cm	mg/100 g soil								
0-20	-	-	-	-	-	-	-	-	-
35-45	-	-	-	-	-	-	-	-	-
60-70	-	51.9	23.0	24.0	25.0	1.5	1.6	13.8	158.4
90-100	-	36.6	35.5	10.6	15.0	4.5	-	16.1	107.4

*TERRITORIAL LAND UNIT (U.S.) No. 3.*  
**GLEYSOL** calcareous salsodic alluvium, salinized/moderately alkalized / weakly proxicalcareous, LA/LA on fine fluvial deposits.  
*Location:* Prahova County, Drăgănești Administrative Territory.

*Distribution:* in the center of the studied territory and in the south of the village of Cornu de Jos.

*Aspect of the land surface:* high alluvial plateau – micro depression, slope 07%.

*Natural conditions in which it occurs:* drifting plain, water table Q3 1.01-2.00 m, water ponding for a large period of the year and in some areas permanently, reed cover (Table 5).

**CHARACTERISTICS OF THE SOIL**

**Horizon A<sub>tgsc</sub> 0-06 cm**, marbled brown color 7.5Y 3/2, massive structure, clay loam texture, moderate effervescence, low porosity, moderately compact, soft;

**Horizon AmGoxsc 06-26 cm**, marbled brown color 7.5Y 3/21 with oxidation spots 10R 5/8,

massive structure, clay loam texture, moderate effervescence, low porosity, moderately compact, soft;

**Horizon ACGoxsc 27-45 cm**, marbled brown color 7.5Y 3/21 with oxidation spots 10R 5/8, massive structure, clay loam texture, strong effervescence, low porosity, moderately compact, jiggly;

**Horizon CkGrsc 45-75 cm**, dark burgundy color 5P 3/1 with oxidation spots 10R 5/8, massive structure, clay loam texture, strong effervescence, low porosity, moderately compact, moist;

**Horizon Ck1Grsc 75-100 cm**, dark burgundy color 5P 3/1, massive structure, clay texture, moderate effervescence, low porosity, moderately compact, moist;

**Horizon Ck2Grsc from 100 cm**, dark burgundy color 5P 1.7/1, massive structure, clay texture, weak effervescence, low porosity, moderately compact, wet (Table 6).

Table 5. Physical characteristics of the Gleysols

Depth	Soil reaction pH (pH)	(CaCO <sub>3</sub> )	Humus (H)	Phosphorus (P)	Potassium (K)	Coarse sand (Ng)	Fine sand (Nf)	Loam (P I+II)	Clay (A)	Physical clay (Af)
cm		%	%	ppm	ppm	%	%	%	%	%
0-20	7.98	3.8	4.32	30.8	236.0	0.2	23.7	37.8	38.3	61.2
30-40	7.97	4.6	3.84	22.4	172.0	0.2	18.7	38.6	42.5	71.2
60-70	8.10	6.1	-	14.9	216.0	0.3	19.7	41.4	38.6	71.1
90-100	7.84	2.5	-	-	-	0.2	17.7	30.5	51.9	79.2
110-120	7.82	1.7	2.82	-	-	0.3	12.0	28.9	58.8	83.4

Table 6. Chemical characteristics of the Gleysols

Depth	CO <sub>3</sub> <sup>2-</sup>	HCO <sub>3</sub> <sup>-</sup>	Cl <sup>-</sup>	SO <sub>4</sub> <sup>2-</sup>	Ca <sup>2+</sup>	Mg <sup>2+</sup>	K <sup>+</sup>	Na <sup>+</sup>	Total salts
cm	mg/100 g soil								
0-20	-	54.9	85.2	145.4	84.0	14.4	5.1	18.4	460.0
30-40	-	61.0	55.0	139.2	68.0	14.4	2.3	18.4	380.0
60-70	-	506	63.9	193.9	37.4	50.0	2.0	23.0	420.8
90-100	-	70.1	69.2	117.1	71.0	5.6	3.5	25.3	400.1
110-120	-	70.2	94.1	72.0	70.0	7.7	3.1	25.3	374.8

*TERRITORIAL LAND UNIT (U.S.) No. 4.*  
**TECHNOSOLS** spoliic aline calcareous lithic, weakly salinized proxicalcareous epilithic, LL/LLq3 on anthropogenic deposits (permeable gravels).

*Location:* Prahova County, Drăgănești Administrative Territory.

*Distribution:* in the southeast of the studied territory.

*The aspect of the land surface:* high alluvial plateau – filling, slope 0.1%.

*Natural conditions in which it occurs:* drift plain, groundwater Q4 4.01-10.00 m (Table 7).

**CHARACTERISTICS OF THE SOIL**

**Horizon A<sub>t</sub> 0-03 cm**, light yellowish brown color 10YR 6/4, monogranular structure, clay

texture, strong effervescence, low porosity, moderately compact, dry.

**Horizon ACk 03-20 cm**, light yellowish brown color 10YR 6/4, monogranular structure, clay texture, strong effervescence, low porosity, moderately compact, dry.

**Horizon CkR 20-40 cm**, light yellowish brown color 10YR 6/4, monogranular structure, clay texture, strong effervescence, very high porosity, very compact, dry, skeleton 70%.

**Horizon R from 40 cm**, permeable gravels (Table 8).

Table 7. Physical characteristics of the Tehnosols

Depth	Soil reaction (pH)	(CaCO <sub>3</sub> )	Humus (H)	Phosphorus (P)	Potassium (K)	Coarse sand (Ng)	Fine sand (Nf)	Loam (P I+II)	Clay (A)	Physical clay (Af)
cm		%	%	ppm	ppm	%	%	%	%	%
0-20	8.10	7.0	1.44	29.9	224.0	11.4	37.4	28.6	22.6	40.8

Table 8. Chemical characteristics of the Tehnosols

Depth	CO <sub>3</sub> <sup>2-</sup>	HCO <sub>3</sub> <sup>-</sup>	Cl <sup>-</sup>	SO <sub>4</sub> <sup>2-</sup>	Ca <sup>2+</sup>	Mg <sup>2+</sup>	K <sup>+</sup>	Na <sup>+</sup>	Total salts
cm	mg/100 g soil								
0-20	-	54.9	24.8	57.6	48.0	1.4	3.9	7.0	200.0

## RESULTS AND DISCUSSIONS

Following the laboratory analyzes regarding the soil reaction, we have the following situation in Table 9.

The communal territory of Drăgănești is mostly occupied by moderately and weakly acidic soils, representing 3211 ha (89%). Strongly acidic soils are found on approximately 157 ha (4.0%). Neutral soils occupy 26.0 Ha (0.5%), and slightly alkaline soils 208 Ha (6%). On acidic surfaces, calcareous amendment accompanied

by organic fertilization is required. It is not recommended to use chemical fertilizers with an acidic physiological reaction such as nitrate and ammonium sulfate. It is recommended to apply nitrolimestone and complex fertilizers 22:22:0, 16:48:0 that provide nitrogen fertilization and correct soil acidity.

These measures will be taken after the application of the other agropedo-ameliorative measures to stabilize and reduce excess moisture (Ilie, 2019).

Table 9. Soil reaction (pH)

Soil reaction	Surface	
	ha	%
strongly acid soils	157.0	4.0
moderately acid soils	2532	70.0
weakly acid soils	679	19.0
neutral soils	26	0.5
weakly alkaline soils	208	6.0
moderately strongly alkaline soils	26	0.5
TOTAL:	3628	100.00

The main source of nitrogen in the soil is humified organic matter. The evaluation of the state of soil provision with this element was made on the basis of the humus content. It correlates directly with the degree of saturation in bases (V%), resulting in the nitrogen index (IN = (H% x V%)/100). The provision of soils with nitrogen is weak and moderate. To correct this condition, organic fertilization is required in

doses established according to the morphological situation of each type of soil and the values resulting from the analyses. In addition, chemical fertilizers will be used, respecting the appropriate agricultural techniques, and in accordance with the Code of Good Agricultural Practices. We find a good nitrogen supply situation on the surface of approximately 350 Ha (10%), following the

values of the other agrochemical indices correlated with the pH value, we conclude that

the correct fertilization of the soil has been achieved here (Table 10).

Table 10. Humus H% content and nitrogen supply (IN)

Nitrogen supply (IN)	Surface	
	ha	%
poorly supplied soils	2027	56
moderately supplied soils	1251	34
well supplied soils	350	10
<b>TOTAL:</b>	<b>3628</b>	<b>100.00</b>

The Riehm index is a synthetic indicator that characterizes the reaction of the soil and the state of supply with the main nutritional elements (phosphorus, potassium) (Cerbari et Stagarescu, 2016). The Riehm index for phosphorus is calculated by adding the percentages from well

and very well supplied soils with half of the percentages of moderately supplied soils (Table 11). The result is a value of 55.76%, characterizing a representativeness of soils moderately-well supplied with mobile phosphorus.

Table 11. Mobile phosphorus (P) supply status

Insurance with mobile phosphorus (ppm P)	Surface	
	ha	%
very poorly insured soils	26.0	0.5
poorly secured soils	731.0	20.0
moderately safe soils	1697.0	47.0
well secured soils	810	22.0
very well safe soils/excessive for some crops	364	10.5
<b>TOTAL:</b>	<b>3628</b>	<b>100</b>

The Riehm index for potassium is calculated by adding the percentages from well and very well supplied soils with half of the percentages of moderately supplied soils. The result is a value of 99.5%, which represents soils well and f. well supplied with potassium for the studied territory. Most of the soils that belong to the communal territory of Drăgănești are well and very well

provided with potassium and occupy 3602 Ha (99.5%), and the moderately provided 26.0 ha (0.5%). To correct the deficiency, as well as on well and very well-supplied soils, potassium chemical fertilization is recommended, with doses corresponding to the respective situation (Table 12).

Table 12. Supply status with accessible forms of potassium

Providing soils with mobile potassium (ppm K)	Surface	
	ha	%
moderately safe soils	26.0	0.5
well secured soils	1201	33.0
very well secured soils	2401	66.5
<b>TOTAL:</b>	<b>3628</b>	<b>100</b>

## CONCLUSIONS

According to the research and depending on the intensity of the limiting factors, 2363 ha of the arable surface, representing 72.62% of the surface of the Drăgănești commune, are lands with severe limitations in the case of arable use

that require intensive measures of development and/or improvement.

In class II a of pretability are classified 511 ha of the arable area of the commune, respectively 15.7%, land with reduced limitations, with good pretability to arable.

Only 0.77% of the arable area of Drăgănești includes land classified as arable class I, very good land for crops, without any restrictions.

There is also an area of 167 ha with very severe land limitations when used in arable, unpretentious in conditions of non-arrangement or complex measures.

In case of the pre-tability of the soils from Drăgănești locality for the use of pastures and

hay meadows, we can notice that there are no lands in first class of pretability, the largest area being 103 ha, respectively, it is occupied with lands of class IV a, land with severe limitations on pastures.

In the II-th class we have 70 ha of land with reduced limitations as pastures and hay meadows, in class III a we have 73 ha of land which for their use as pastures the limitations are moderate, and in class a we also have 73 ha, land with severe limitations for use as pastures and hay meadows.

As regards the pretability of the viticulture use, we also note that the largest land area used for the vineyards is classified in class IV a of pre-ability, as, respectively 55 ha (42.97% of the vineyard area), followed by 44.5 ha in the first class iI of the pretability, respectively 34.775 of the vineyard area, 24 Ha are in the pretability class III a and only 4.5 ha are with very severe limitations when used as vineyards.

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